

REMARKS:

Minor changes are made to the Specification. Claims 1, 5 and 7 are amended; marked up versions of the amended claims are attached hereto pursuant to 37 C.F.R. § 1.121(c)(ii). Claims 1-17 are pending in the application. Reexamination and reconsideration of the application, as amended, are respectfully requested.

Proposed revised Figures 5A, 5B, 6 and 7 with red ink markings showing the proposed changes are submitted herewith for entry and approval by the Office. Specifically, in Figures 5A and 5B, reference numerals "31" and "32" are replaced with --32-- and --31--, respectively. In Figure 6, reference numerals "40" and "41" are replaced with --41-- and --40--, respectively. In Figure 7, reference numerals "46" and "47" are replaced with --47-- and --46--, respectively. In each Figure, the reference numerals are changed to correct an inadvertent error in identifying the referenced item. Approval of the proposed drawing changes is respectfully requested.

Claims 1-4, 7-11 and 13-16 stand rejected under 35 U.S.C. § 102 (b) as being anticipated by Beckwith (U.S. Patent No. 5,615,292). Claims 1 and 7 have been amended. Applicant respectfully traverses the rejection as to the amended claims.

The present invention relates to an optical module and a connecting structure for an optical module which are used mainly in an optical communication equipment or the like. The optical modules and connection structures of the present invention enable secure and easy mounting on an electric circuit board and are highly reliable.

Claim 1 of the present invention is as follows:

1. An optical module comprising:  
a substrate having a groove in a surface of the  
substrate;  
an electric connection terminal provided on the  
substrate;

an optical element provided on the substrate, the optical element being connected with the electric connection terminal; and

one end of a slender light transmitter fixed in the groove and optically coupled with the optical element.

(emphasis added)

According to one aspect of the present invention and referring to Figures 1A and 1B, the optical module M1 includes connection terminals formed of copper wires at one end 1a of a package 1. The optical elements are electrically connected with the connection terminals. The optical elements include a light emitting element 3, a light receiving element 4 and an optical fiber 5 serving a slender light transmitter having one end optically connected to the light emitting element 3. These elements are arranged on a substrate 6. In the present invention, at least one end of the optical fiber 5 is arranged in the package 1. In one aspect of the present invention, a v-shaped groove for mounting the optical fiber 5 is formed in a main surface of the substrate 6 with high precision by anisotropic etching. (See Specification, at p. 7, line 7- p. 8, line)

Applicant respectfully asserts that Beckwith cannot anticipate the presently claimed invention because Beckwith does not teach "a substrate having a groove in a surface of the substrate" or "one end of a slender light transmitter fixed in the groove and optically coupled with the optical element." Beckwith is directed to a terminator for permanent connection to either end of a fiber optic cable which then provides transmission of electrical TTL logic signals from one end to the other. (See Beckwith, Abstract). Referring to FIG. 3, Beckwith requires flexible tubing 5 to provide strain relief for fiber optic cable 4. (Beckwith at 2:58-60) In Beckwith, both tubing 5 and cable 4 being retained in openings 20 and 21 in body 2. (Beckwith at 2:59-60) In Figure 3, Body 2 is shown with cover 1 removed as required to permit assembly within body 2 of a known type of light sender 9 such as a Hewlett Packard HFBR1528, a known type of light receiver 10 such as a Hewlett Packard HFBR2528 and associated circuit 11 on printed circuit board 12. (Beckwith at 2:60-65).

Beckwith does not teach or suggest "a substrate having a groove in a surface of the substrate" as is required by claim 1. Beckwith requires that both tubing 5 and cable 4 inserted through openings 20 and 21 in body 2. (Beckwith at 2:59-60). Nothing in Beckwith teaches a construction in which the cable 4 and tubing 5 are not fixed through opening in the body 2. Further, nothing in Beckwith either teaches or suggests a construction in which the substrate has a groove on a surface of the substrate as is required by claim 1. Since Beckwith fails to teach or suggest this claim limitation, Beckwith cannot anticipate or render obvious the invention of claim 1.

Further, nothing in Beckwith teaches or suggests a construction with "one end of slender light transmitter fixed in the groove and optically coupled with the optical element." In Beckwith, flexible tubing 5 provides strain relief for fiber optic cable 4. (Beckwith at 2:58-60) Further, both tubing 5 and cable 4 are retained in openings 20 and 21 in body 2. (Beckwith at 2:59-60) Conversely, in the present invention, the slender light transmitter is fixed in a groove on the surface, no flexible tubing 5 is used and as such, only the slender light transmitter is fixed in the groove. Nothing in Beckwith either teaches or suggests a construction in which a slender light transmitter is fixed in a groove, in which flexible tubing 5 may be omitted or in which slender light transmitter is fixed in the opening without the assistance of tubing 5. Since Beckwith fails to teach or suggest this claim limitation, Beckwith cannot anticipate or render obvious the claimed invention. As such, claim 1 patentably distinguishes over Beckwith.

Claims 2-4 depend from claim 1 either directly or through intervening claims. As such, claims 2-4 are patentable for at least the same reasons as claim 1. Withdrawal of the rejection and allowance of claims 2-4 is respectfully requested.

As with claim 1, claim 7 includes the limitations requiring "a substrate having a groove in a surface of the substrate" and "one end of a slender light transmitter fixed in the groove and optically coupled with the optical element." Claim 7 is therefore patentable for at least the same reasons as claim 1 (described

above). Withdrawal of the rejection and allowance of claim 7 is respectfully requested.

Claims 8-11 and 13-16 depend from claim 7 and are patentable for at least the same reasons as claim 7. Withdrawal of the rejection and allowance of claims 8-11 and 13-16 is respectfully requested.

Claims 5-6, 12, and 17 stand rejected under 35 U.S.C. § 102 (b) as being anticipated by Beckwith (U.S. Patent No. 5,615,292). Claim 5 has been amended. Applicant respectfully traverses the rejection of the claims as amended.

As with claim 1, claim 5 includes the limitations requiring "a substrate having a groove in a surface of the substrate" and "one end of a slender light transmitter fixed in the groove and optically coupled with the optical element." Claim 7 is therefore patentable for at least the same reasons as claim 1 (described above). Withdrawal of the rejection and allowance of claim 5 is respectfully requested.

Claim 6 depends from claim 5 and is patentable for at least the same reasons as claim 5. Withdrawal of the rejection and allowance of claim 6 is respectfully requested.

Claims 12 and 17 depend from claim 7. Applicant has already discussed how claim 7 patentably distinguishes over Beckwith. As such, claims 12 and 17 are patentable for at least the same reasons as claim 7. Withdrawal of the rejection and allowance of claims 12 and 17 is respectfully requested.

The art made of record but not relied upon by the Examiner has been considered. However, it is submitted that this art neither describes nor suggests the presently claimed invention.

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Reexamination and reconsideration of the application, as amended, are requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los

Angeles, California telephone number (213) 337-6700 to discuss the steps necessary for placing the application in condition for allowance.

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-1314.

Respectfully submitted,

HOGAN & HARTSON L.L.P.

Date: June 19, 2002

By: 

Lawrence J. McClure

Registration No. 44,228

Attorney for Applicant(s)

500 South Grand Avenue, Suite 1900  
Los Angeles, California 90071  
Phone: 213-337-6700  
Fax: 213-337-6701

**Version with markings to show changes made:**

1. (Amended) An optical module comprising:
  - a substrate having a groove in a surface of the substrate;
  - an electric connection terminal provided on the substrate;
  - an optical element provided on the substrate, the optical element being connected with the electric connection terminal; and
  - one end of a slender light transmitter fixed in the groove [on the substrate] and optically coupled with the optical element.
  
5. (Amended) An optical module comprising:
  - a substrate having a groove in a surface of the substrate;
  - an electric connection terminal provided on the substrate;
  - a planer lightwave circuit provided on the substrate, the planer lightwave circuit being connected with the electric connection terminal; and
  - an optical fiber partially provided in the groove [on the substrate] and optically coupled with the planer lightwave circuit.
  
7. (Amended) A combination comprising:
  - a connector connectable with an electric circuit board; and
  - an optical module including:
    - a substrate having a groove in a surface of the substrate;
    - an electric connection terminal provided on the substrate, the electric connection terminal electrically connectable with the connector;
    - an optical element provided on the substrate, the optical element being connected with the electric connection terminal; and
    - one end of a slender light transmitter fixed in the groove [on the substrate] and optically coupled with the optical element.